

THE IRAP ROAD SAFETY TOOLKIT – A WEBSITE-BASED APPROACH TO ADDRESSING ROAD SAFETY PROBLEMS

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ABSTRACT

The World Report on Traffic Injury Prevention (issued jointly by the World Health Organisation and the World Bank) drew attention to the urgent need for action to reduce road traffic injuries globally. Its key conclusion was that, in order to achieve safer roads, a 'Safe System' approach was needed. This means that a road system should be designed to accommodate, and compensate for, human vulnerability and frailty. An essential element of the Safe Systems approach is accurate and accessible information on the causes of crashes and possible solutions to the identified road safety problems.

This paper presents an overview of the Road Safety Toolkit, which was developed by ARRB for iRAP (the International Road Assessment Programme) in association with the Global Transport Knowledge Partnership (gTKP). It is a free on-line tool that is designed to assist in the analysis of crashes, or issues relating to specific road user groups, and in the selecting of the most appropriate road safety engineering treatments. Where appropriate, the Toolkit also identifies non-engineering solutions, such as enforcement and road user education programs. Plans for future refinements in the Toolkit are also discussed.

1. INTRODUCTION

Worldwide, deaths and injuries from road traffic crashes are a major and growing public health epidemic. Each year, 1.3 million people die and up to 50 million are injured or permanently disabled in road crashes [1]. This equates to over 3,000 deaths per day. For developing countries, where almost nine out of ten road deaths and injuries occur, road trauma represents a serious and rapidly worsening public health crisis with road traffic injuries expected to increase substantially by 2020 unless some form of action is taken [2].

In addition to the human cost of bereavement, research shows that road crashes are often the factor responsible for tipping a household into financial distress. The loss of a breadwinner due to death or disability can be disastrous, leading to lower living standards and poverty [2].

The World Report on Traffic Injury Prevention [2] (issued jointly by the World Health Organisation and the World Bank) drew attention to the urgent need for action to reduce road traffic injuries globally. A key conclusion was that, in order to achieve safer roads, a 'Safe System' approach was needed.

The Safe System approach (see for example [3]) provides a holistic view of the combined factors involved in road safety. The approach acknowledges that road users are likely to make errors. It also recognises that there is a limit to the physical forces that can be withstood by road users (for instance during the rapid deceleration experienced during a crash). The Safe System approach seeks to protect responsible road users from death and serious injury by taking human error and frailty into account. It requires that roads need to be designed in a way that prevents crashes from occurring, or that in the event of a crash, that serious and fatal outcomes do not result. The Safe System approach also encourages a better understanding of the interaction between the key elements of the road system: road users, vehicles, roads and roadsides, and travel speeds.

In order to achieve Safe System outcomes, better knowledge is required by those involved in road infrastructure management and delivery of road safety programs. iRAP, the International Road Assessment Program, recognises the difficulties faced by those involved in delivering safety in low-income and middle-income countries. iRAP has been active in raising the profile of road safety in these countries, by identifying high risk locations and in providing effective road safety engineering based solutions. iRAP is active in more than 50 countries and more than 300,000km have now been assessed by Road Assessment Programmes. For further information on iRAP see [3] and www.irap.org.

It was recognised by iRAP that in order to deliver effective road safety outcomes to low-income and middle-income countries, an information tool is required. Together with ARRB Group and gTKP (the Global Transport Knowledge Partnership), a Road Safety Toolkit has been developed by iRAP to meet this objective.

2. THE iRAP ROAD SAFETY TOOLKIT

The Road Safety Toolkit is a free website (www.irap.net/toolkit) that provides information on measures that can be taken to improve safety on the road. It is designed to assist in providing solutions to specific types of crashes, or in response to collisions involving specific road user groups. The title screen for the toolkit can be seen in Figure 1.

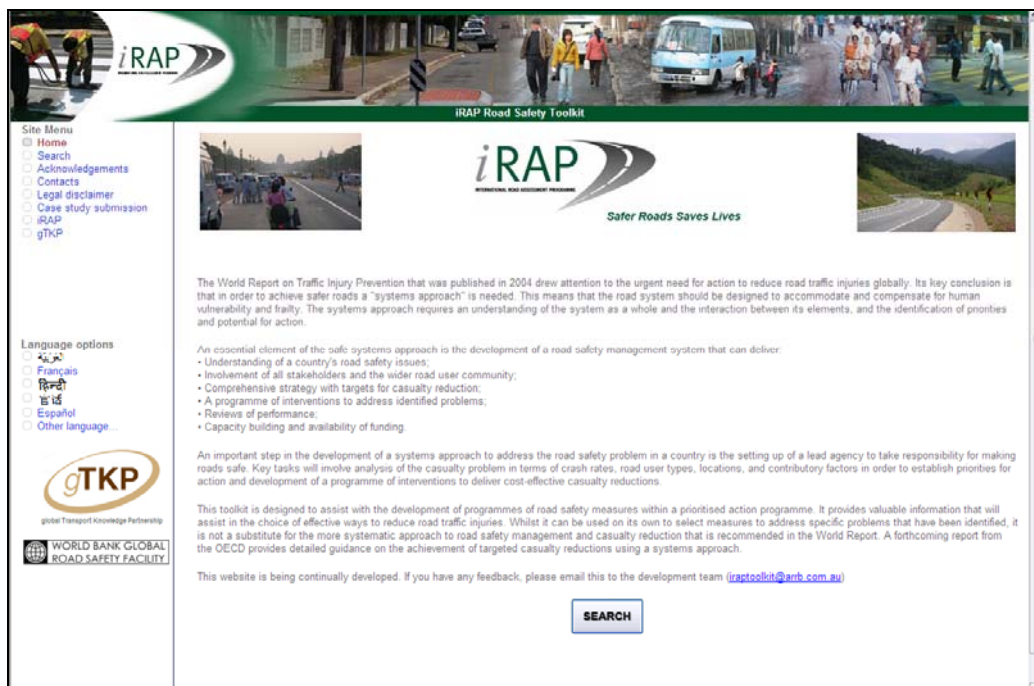


Figure 1. Title screen from Road Safety Toolkit

The Toolkit allows users to search for information on specific types of crashes, or road users using the search screen (see Figure 2). If users are already aware of possible treatments that might be used, they can also select these directly from this same screen.

iRAP
ROAD SAFETY TOOLKIT

Site Menu

- [Home](#)
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- [Case study submission](#)
- [iRAP](#)
- [gTKP](#)

gTKP
Global Transport Knowledge Partnership

WORLD BANK GLOBAL ROAD SAFETY FACILITY

Commence a New Search

Welcome to the iRAP Road Safety Toolkit search page.

Click on the **Crash Types** menu to select information on the causes of the dominant crash types at your location. Click on the **Road User Types** menu to select information on crashes and treatment types that apply to specific Road User Types.

Following either approach will lead you to detailed information on cost effective road safety engineering treatments. Alternatively, click on the **Treatment Types** menu to go directly to a relevant treatment. References for technical guidelines and standards have been included to assist in detailed development of solutions.

Crash Types
Please choose from list...

Road User Types
Please choose from list...

- Car Occupants
- Cyclist
- Heavy Vehicle
- Motorcyclist
- Pedestrians**
- Public Transport Vehicle

extensive research. However, the information is provided as a guide only and does not replace formal training in road safety.

arab Collaborating with the Road Industry to turn knowledge into practice

Figure 2. Search screen from Road Safety Toolkit

Crash types have been grouped into the following major categories:

- head-on
- intersections
- lane change
- manoeuvring
- rear end
- run off road
- vehicle – cyclist
- vehicle – pedestrian.

Safety issues relating to the following road user groups can also be selected:

- car occupants
- cyclists
- heavy vehicles
- motorcyclists

- pedestrians
- public transport vehicles.

When a crash type or road user type is selected, information is displayed about that specific issue (see Figure 3). This information includes details about the major causes of that crash type as well as the types of treatments that can be used to address that problem.

The screenshot displays the iRAP Road Safety Toolkit interface. The main content area is titled 'Crash type: Vehicle – pedestrian'. It includes a 'Description' section with text about pedestrian vulnerability and a list of common collision situations. To the right, there is a 'Pictures' section with a photo of a pedestrian crossing and a 'Related road user types' section with links to Car Occupants, Heavy Vehicle, Motorcycle, Pedestrians, and Public Transport Vehicle. Below the description is a 'Treatment types' table comparing various engineering countermeasures based on cost and effectiveness. At the bottom, there is a section for 'Alternative non-engineering measures' including police enforcement, speed limit enforcement, media campaigns, and road safety education.

Crash type: Vehicle – pedestrian

Description

Pedestrians are amongst the most vulnerable of road users. In many countries, collisions with pedestrians are a leading cause of death and injury. In some countries, over half of all road deaths are caused by collisions between vehicles and pedestrians.

Collisions between pedestrians and vehicles occur in a number of situations, including:

- walking in to the path of a vehicle, especially while trying to cross the road
- walking along the roadside, or on the road
- playing or working on the road
- on driveways or footpaths
- while boarding or leaving public transport vehicles.

The severity of pedestrian crashes is strongly dependent on the speed of traffic. Research shows that the chances of a pedestrian surviving an impact with a motorised vehicle reduces dramatically above 30 km/h, and even at lower speeds than this, serious harm can be caused, especially to elderly or child pedestrians.

The risk of pedestrian injuries is increased by a number of factors that relate to the road environment, including:

- high speed of traffic
- inadequate crossing facilities
- lack of pedestrian crossing opportunities (gaps in passing traffic)
- number of lanes to cross
- complexity and unpredictability of traffic movements at intersection
- inadequate separation from traffic
- poor crossing sight distance.

Pictures

Image 1 of 4

Related road user types

- [Car Occupants](#)
- [Heavy Vehicle](#)
- [Motorcyclist](#)
- [Pedestrians](#)
- [Public Transport Vehicle](#)

Treatment types

Suitable engineering countermeasures include:

	Cost	Effectiveness
Central Hatching	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Speed Management	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Parking Improvements	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Pedestrian Crossing - Grade Separation	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Pedestrian Crossing - Unsignalised	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Pedestrian Footway	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Regulate Roadside Commercial Activity	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Pedestrian Crossing - Signalised	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Pedestrian Refuge Island	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Restrict/Combine Direct Access Points	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Shoulder Sealing	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Traffic Calming	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️
Service Road	🌱🌱🌱🌱🌱	❤️❤️❤️❤️❤️

Alternative non-engineering measures

- Police enforcement of road crossing rules (especially where illegal pedestrian movements are observed) e.g. [penalty system in New Zealand](#) [ADB guidance on traffic police and enforcement](#)
- Speed limit enforcement (enforcement of the desired speed limit, especially during high-risk times) See the GRSP [Speed Management Manual](#)
- Speed media campaigns (promoting safe driver speeds, particularly in pedestrian areas) See the [Speed Management Manual](#)
- Road safety education and training (safe routes to school, education programs targeted at safe pedestrian behaviour and improving driver awareness of pedestrians) e.g. [information on road safety education campaigns in Victoria, Australia](#) [ADB guidance on road safety publicity and campaigns](#)
- Blood alcohol / drug content testing for drivers (especially in entertainment areas or near to at-risk establishments) See the GRSP [Drink Driving Manual](#)

Figure 3. Information on vehicle-pedestrian collisions

Currently, the Road Safety Toolkit includes detailed information about the road engineering measures that might be used to address the problem. These correspond with the countermeasures used in iRAP projects (see [4] for more information). Links to further information for non-engineering measures is also provided (e.g. enforcement, education, publicity).

Each engineering measure that could be used to treat that crash type is listed in order from lowest cost to highest cost. Information is also provided on the expected effectiveness in terms of crash reduction (i.e. the expected percentage reduction in casualty crashes). This information is based on an extensive review of research by Austroads [5].

From the available list, users are able to select specific road engineering treatments. A full list of currently available treatments is provided in Table 1, while Figure 4 provides an example of a treatment page (pedestrian refuge islands).

Table 1. Current Road Safety Engineering Treatments in Toolkit

Additional lane (includes overtaking lane)	Pedestrian refuge island
Bicycle facilities (on- and off-road)	Pedestrian crossing – unsignalised
Central hatching	Pedestrian crossing – signalised
Central turning lane full length	Pedestrian footpath
Delineation	Railway crossing
Duplication	Realignment – horizontal
Intersection – delineation	Realignment – vertical
Intersection – grade separation	Regulate roadside commercial activity
Intersection – right turn lanes (signalised)	Restrict/combine direct access points
Intersection – right turn lanes (unsignalised)	Road surface upgrade
Intersection – roundabout	Roadside safety – barriers
Intersection – signalise	Roadside safety – hazard removal
Lane widening	Rumble strip / flexi-post
Median barrier	Service road
Motorcycle lanes	Shoulder treatment
One way network	Speed management
Parking improvements	Traffic calming
Pedestrian crossing – grade separation	

The screenshot shows the IRAP Road Safety Toolkit interface. At the top, there's a banner image of a busy street with pedestrians and a bus. Below the banner, the page is titled "Treatment type: Pedestrian Refuge Island".

Site Menu: Home, Search, Acknowledgements, Contacts, Legal disclaimer, Case study submission, IRAP, gTKP.

Logos: gTKP (Global Transport Knowledge Partnership) and WORLD BANK GLOBAL ROAD SAFETY FACILITY.

Description:

- Most pedestrian crashes happen while the pedestrian is attempting to cross the road. Crossing a busy road with fast flowing traffic can be very difficult. Pedestrian refuge islands can help pedestrians to cross such roads safely. They can be used where there is a demand for pedestrians to cross the road, but where the numbers of pedestrians are not high enough to warrant a [signalised pedestrian crossing](#).
- Pedestrian refuge islands are raised median islands that provide a location for pedestrians to safely wait for a gap in the traffic so they can finish crossing the road. This makes crossing the road easier for pedestrians by allowing them to cross in two stages and deal with one direction of traffic flow at a time.
- Pedestrian refuge islands should ideally be at least 1.8 metres wide (narrow refuge islands put pedestrians at risk of being hit by truck side mirrors) and can be part of an [unsignalised pedestrian crossing](#).
- Refuge islands are usually used on wide, multi-lane roads. They can be helpful where pedestrian crossings would result in traffic congestion.
- Traffic islands at intersections can also act as refuge islands (especially to assist in movement across the minor road), and provide additional safety benefit at these locations.

Benefits:

- Reduced pedestrian crashes
- Separating traffic moving in opposite directions to reduce head-on and overtaking crashes.
- May slow vehicular traffic by narrowing the lanes.

Implementation issues:

- Pedestrian refuge islands must be clearly visible to traffic during both day and night.
- Refuge islands should be placed where there is a demand from pedestrians to cross.
- Where cyclists are present, refuge islands must not narrow the lanes too much.
- Turning movements from driveways and intersections must be considered in planning the location of pedestrian refuges.

Treatment Summary:

- Cost: [Icon]
- Treatment life: [Icon]
- Effectiveness: [Icon]

Pictures: [Image of a pedestrian refuge island on a road]

Crash reduction effectiveness:

- Crash reduction benefit = 15% reduction with the introduction of refuge islands

Technical references:

- Towards Safer Roads, p. 172 - 173. TRB report. See [TRB_Report](#)

Other treatments to consider:

- Central Hatching
- Delineation
- Speed Management
- Parking Improvements
- Pedestrian Crossing - Grade Separation
- Pedestrian Crossing - Unsignalised

Figure 4. Information on pedestrian refuge islands

Each treatment page describes the treatment, including information on the benefits of that treatment and any implementation issues. A summary is provided on the cost of the treatment, the treatment life (i.e. how long the treatment can be expected to continue providing a safety benefit before it will need to be renewed), and its effectiveness in terms of casualty reduction. Photos are provided showing examples of the treatment (see Figure 5), and links provided so that more detailed information can be obtained from external technical sources and manuals.

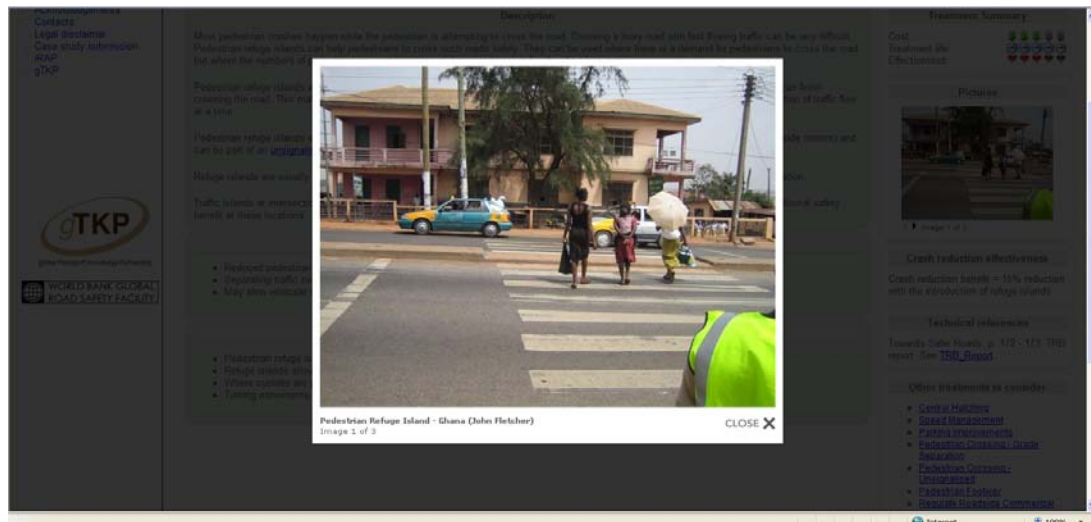


Figure 5. Photos are provided of specific engineering treatments

Data underpinning the Toolkit is derived from numerous sources:

- Information on crash reduction factors is primarily based on extensive research by Austroads [5], but also supplemented by other robust research, including the *Handbook of Road Safety Measures* [6] and *Safer Roads: A Guide to Road Safety Engineering* [7].
- Extensive use has been made of various manuals, including:
 - Towards Safer Roads [8]
 - The Austroads series of Guides [9]
 - GRSP guides on speed management [10] and drink driving [11].

3. FUTURE DEVELOPMENTS

To date, the Road Safety Toolkit has been accessed by practitioners in more than 90 countries. It is hoped that with further refinement and additional promotion, the website will be accessed by an even greater number of users.

The information currently provided in the Toolkit is focused on road engineering based solutions although, where appropriate, the Toolkit also identifies non-engineering solutions (such as enforcement and road user education programs). In line with the holistic Safe System approach, the website will soon be enhanced to provide detailed information on road safety solutions relating to people, vehicles and roads, in the context of travel speeds. It is also hoped to include material on a broader range of issues, for example road safety management and data systems.

The Toolkit currently has provision for the submission of case studies. This feature has not been well utilised to date, and so future efforts will be made to provide case studies of relevance to low and middle income country users. Given that a great proportion of the world's population does not speak English, it is also hoped to provide translations into other languages.

4. SUMMARY

The Road Safety Toolkit has been developed to provide comprehensive, accessible information on road safety treatments to practitioners. It is a free web-based tool that acts as a source of information on ways to improve safety specifically in developing and middle income countries. It is a 'living' document that can be easily updated in light of new treatments and methods, or to broaden the range of issues covered. Future improvements are planned for the website, and it is hoped that these, combined with increased promotion will see an increase in the usage of this important resource.

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